EIGHTEENTH ANNUAL REPORT

OF THE

South Carolina Experiment Station,

OF THE

CLEMSON AGRICULTURAL COLLEGE,

FOR THE YEAR ENDING

JUNE 30, 1905.

COLUMBIA, S. C.
THE STATE CO., PRINTERS.
1906.

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Freight and express: Calhoun, S. C.

The bulletins of the Station are issued at irregular intervals, and are sent free to all citizens of the State who apply for them.

CLEMSON COLLEGE, S. C., December 31, 1905.

Hon. D. C. Heyward, Governor of South Carolina.

Sir: I have the honor to submit herewith the Eighteenth Annual Report of the South Carolina Agricultural Experiment Station, in accordance with the requirements of an Act of Congress approved March 2, 1887, for the Establishment of Agricultural Experiment Stations in connection with the Colleges of the several States, organized under the provisions of an Act approved July 2, 1862.

Respectfully submitted,

P. H. MELL,
President.

THE SOUTH CAROLINA EXPERIMENT STATION IN ACCOUNT WITH THE UNITED STATES APPROPRIATION, 1904-1905.

Dr.

To Receipts from the Treasurer of the United States as per appropriation for fiscal year ended June 30, 1905, as per act of Congress approved March 2, 1887.....$15,000 00

Cr.

By Salaries	$ 9,878 92
Labor	1,423 58
Publications	1,560 02
Postage and stationery	105 28
Freight and express	75 99
Heat, light, water, and power	122 75
Chemical supplies	483 12
Seeds, plants, and sundry supplies	261 65
Fertilizers	490 90
Feeding stuffs	.....
Library	59 12
Tools, implements, and machinery	14 32
Furniture and fixtures	21 86
Scientific apparatus	3 55
Live stock	38 09
Traveling expenses	379 65
Contingent expenses	31 20
Buildings and repairs	.....
Balance	.....
Total	$15,000 00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Clemson Agricultural College for the fiscal year ended June 30, 1905; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00, and the corresponding disbursements $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving no balance.

And we further certify that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887.

(Signed) R. W. SIMPSON,
Chairman Committee.

[SEAL.]
Attest:
P. H. E. SLOAN,
Custodian.

ABSTRACT—SALARIES.

Director and administrative officers	No. 4	Amount	$3,299 92
Scientific staff	No. 9	Amount	5,479 08
Assistants to scientific staff	No. 3	Amount	1,099 92
Special and temporary services			.....
Total			$9,878 92

ABSTRACT—PUBLICATIONS.

For printing 25 Bulletins—No. of pages 391. Total edition 300,000)	$1,501 75
For printing Annual Report—No. of pages 26. (Total edition 1,000)	40 50
For envelopes for bulletins and reports	17 77
Other expenses	.....
Total	$1,560 02

ABSTRACT—SEEDS, PLANTS, AND SUNDRY SUPPLIES.

Agricultural	$ 88 00
Horticultural	114 96
Botanical	31 47
Entomological	.....
Miscellaneous	27 22
Total	$ 261 65

ABSTRACT—CONTINGENT EXPENSES.

College and Experiment stations	$ 15 00
Keys	94
Nose rings	1 25
Stationery	3 53
Calf feeders	5 08
W. C. paper	5 40
Total	$ 31 20

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION, 1904-1905.—SUPPLEMENTARY STATEMENT.

[This supplementary statement, while not required by law, is desired as an aid in interpreting the account rendered for the United States appropriation.]

	State.	Local Community.	Individuals.	Fees.	Farm Products.	Miscellaneous.	Total.
Dr.							
Balance	.....	.....	.....	.....	.....	.....	$ 982.27
To Receipts from other sources than the United States for the year ended	$1,620.83	$....	$....	$....	$960.70	$1,653.07	4,234.60
							$5,216.87
Cr.							
Labor	$.....	$....	$....	$....	$.....	$.....	$ 173.15
Registered herd	.....	.....	.....	.....	.....	.....	1,653.07
Publications	.....	.....	.....	.....	.....	.....	340.75
Coast Experiments	.....	.....	.....	.....	.....	.....	1,620.83
Freight and express	.....	.....	.....	.....	.....	.....	49.88
Heat, light, water and power	.....	.....	.....	.....	.....	.....	23.94
Seeds, plants and sundry supplies	.....	.....	.....	.....	.....	.....	18.32
Fertilizers	.....	.....	.....	.....	.....	.....	67.50
Tools, implements and machinery	.....	.....	.....	.....	.....	.....	22.50
Furniture and fixtures	.....	.....	.....	.....	.....	.....	35.78
Balance	.....	.....	.....	.....	.....	.....	1,211.15
							$5,216.87

Report of the Director.

CLEMSON COLLEGE, S. C., Dec. 8, 1905.

Dr. P. H. Mell, President, Clemson College, S. C.

Dear Sir: I have the honor to submit herewith the reports of the chiefs of divisions of this Experiment Station, forming the material for the Annual Report of the South Carolina Experiment Station for the year ending June 30, 1905.

This is the report of the work done under the general supervision of my predecessor, Col. J. S. Newman. After his retirement it was with pleasure that I assumed the duties and responsibilities of an office once filled by so distinguished and beloved a man, and I am happy to find myself associated with a corps of enthusiastic and efficient scientists and educators.

It is my belief that our Experiment Station is destined to be a potent factor in the future development of the material welfare of our state and nation.

Our policy shall be to develop this work in a most conservative way, and along the lines that will be of the greatest practical value to our farmers, stockmen, and horticulturists. While there are yet probably many undiscovered facts relating to science and agriculture, we shall not endeavor to discover all of these at one time, but by thoroughly executing carefully planned experiments, we hope to obtain data which will be of value as long as this commonwealth shall exist.

We do not intend to spend all of our energies in the pursuance of original research work. It is our intention not only to do needed original research work, but actively to disseminate truths already discovered, though not spread among the people, so that the great mass of farmers may be directly and immediately benefited. This we will do by college extension work, farmers' institutes, and popular bulletins.

I take this opportunity to expresss to you my great appreciation of the many valuable suggestions you have given us and of the personal and official interest you have shown in this work.

I am, sir, Yours most respectfully,

(Signed) J. N. HARPER,
Director.

REPORT OF THE ASSOCIATE AGRICULTURIST.

CLEMSON COLLEGE, S. C., Nov. 28, 1905.

Prof. J. N. Harper, Director, S. C. Experiment Station, Clemson College, S. C.

Dear Sir: In accordance with your instruction, I am submitting the following report for the Agricultural Division of the South Carolina Experiment Station for the year ending June 30, 1905:

When I entered upon my duties on June 20, 1905, I inspected the work under way in company with the former Director of the Agricultural Department, and found experiments being carried on with the following: Wheat, oats, beardless barley, corn, cotton, cowpeas, alfalfa, hairy vetch, Soy beans, velvet beans, Newman beans, sweet potatoes, truffle oats, black locust, May-pops and fertilizers.

The object of these experiments briefly stated, was:

Wheat: Variety, fertilizer and cultural tests.

Oats: Variety, fertilizer and cultural tests and a comparison of yields from same varieties, the seed of which were procured from several States.

Beardless Barley: To test its adaptability.

Corn: Variety test conducted in cooperation with the United States Department of Agriculture.

Cotton: Variety test, test of new varieties produced by cross breeding and selection, and fertilizer test. Some sixty-odd varieties were prepared for exhibition on Farmers' Institute car.

Cowpeas: Variety test with a large number of established varieties and new cross-bred productions, the development of strains particularly suited to hay or grain production, and for fertilizing purposes. Forty-odd varieties and strains of these were exhibited on Farmers' Institute car.

Alfalfa: Cultural and inoculation tests.

Hairy Vetch: Cultural, inoculation and soil improvement tests and for hay.

Soy Beans: Soil improvement, hay and grain tests.

Velvet Beans: Soil improvement and cover crop.

Newman Bean: Soil improvement and cover crop.

Sweet Potato: For starch production.

Truffle Oats: For production of truffles.

Black Locust: For growing posts on worn soils.

Maypops: For developing economic value.

Fertilizer Tests: For determining best fertilizers and combinations of fertilizers for different crops; for recuperation of impoverished soils and for their more economic use by utilizing legumes as a source of nitrogen.

Since June 20, 1905, the following experimental work has been undertaken:

Wheat: Twenty-odd varieties planted for variety tests.

Oats: Eight or ten varieties planted for variety test.

Cowpeas: Eighty-odd varieties, crosses and selections planted to determine varieties best suited for grain, hay, soil improvement, cover crop; quantity of seed per acre of different varieties giving best returns and development of new strain suited to special purposes, such as for hay and grain production, uniformity of ripening, green manuring, cover crop and for growing with corn.

Alfalfa: To demonstrate the practicability of making this a profitable hay crop and to test the value of inoculation with nitrogen gathering bacteria.

Crimson Clover: As a winter cover and soil improvement crop, for grazing and for hay.

Hairy Vetch: As a winter cover and soil improvement crop for grazing and for hay; for production of seed for commercial purposes.

Clovers: Several standard varieties of clover to test adaptability to soil and climate.

Grasses: Several standard hay and pasture grasses to test adaptability to soil and climate.

Turnips: Kale, rape and mustard as winter cover crops for soil protection and for furnishing green stock feed in winter months.

Cotton: Some of the cross-bred varieties of cotton found growing seem to possess unusual merits as to productiveness and quality of staple, and extensive plant breeding and selection work has been undertaken that these good qualities may be maintained, if not further developed. Two or three hundred of the best stalks, representing a variety of types, have been

selected that this work may be carried on in a careful manner. The product of each stalk is being critically examined, and the best are to be grown next year for further observation and selection. I deem this the most important work that the Agricultural Division can take up at the present time.

The desideratum of the Experiment Station is the benefit to the farmers of the State by assisting them in securing better yields of products and products of better qualities without increasing the cost of production. The Agricultural Division, in its endeavor to reach these ends, is employing, through experimentation, the following means:

(1) Soil Improvement: a. By mechanical manipulation.
b. By fertilization.

(2) Plant Improvement: a. For increased quality.
b. For improved quality.

(1) The soil is the foundation of all agriculture, and the maintenance and increase of its fertility the basis of plant and animal production. The importance of demonstrating proper manipulation and rational fertilization of soils for various crops cannot be overestimated.

(2) Living things repeat their characteristics in their descendants and the perpetuation of desirable characteristics, whether natural or induced, is one of the most prolific fields for the production of permanent economic results. It is hoped that opportunity and facilities for thoroughly carrying on such work will be given the division.

Respectfully submitted,

C. L. NEWMAN,
Associate Professor of Agriculture.

REPORT OF THE SECRETARY AND LIBRARIAN.

CLEMSON COLLEGE, S. C., Nov. 29, 1905.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: Complying with your instructions, I beg to submit the following report of the work of the office division of the station covering the period of the fiscal year beginning July 1, 1904, and ending June 30, 1905.

The business of this office has continued to grow during the past year, and some new features have been especially de-

veloped, looking to increased efficiency, in diffusing among the people of this State, useful and practical information on subjects connected with agriculture. A Station Council has been organized under plans of the Board of Trustees, that will, at its regular meetings, discuss agricultural problems suited to the requirements of our large agricultural population,—and determine in a general way the character of the experiments for the ensuing year. The minutes of the deliberations of the Station Council are required to be carefully kept.

The activity and success of this station in bringing the results of its work before the agricultural public, continue unabated, as the work becomes more important and more necessary to the welfare of the farmers of the State.

During the year the station has issued one annual report, containing twenty-six pages and twenty-six (26) bulletins, many more than are required by the Hatch Act. These bulletins contain in the aggregate 326 pages, and they were published and distributed in editions of 12,000 copies. The total number of bulletins issued during the year were 312,000. Fifteen of the bulletins referred to above, containing the analyses of commercial fertilizers, were published at the College—and distributed from this office once a week, practically covering the period from the month of January to the end of April—thereby providing the farmers, on more than 10,000 farms in this State, with due notice regarding the quality of fertilizers offered for sale, and well-nigh preventing the sale of any fraudulent goods, in a business in which this State is interested to the amount of not less than $5,000,000. Some of the other bulletins referred to diseases of cattle, dairy management, agricultural and horticultural subjects. A striking evidence of a growing interest in all matters pertaining to this station, may be seen in the statement of the fact that we have made accessions of 1,250 names on the permanent mailing list, within the past year.

A complete file of all bulletins, representing every Experiment Station in the United States and many foreign States, is carefully kept, their numbers and subjects placed on record in the bulletin catalogue, and they are subsequently arranged in appropriate form and bound into volumes. There are now in the station library 430 of such bound volumes of bulletins. It may be

said that this work supplies the materials out of which a definite science of agriculture may be constructed—and on which shorter courses of instruction for various grades of agricultural students may be successfully based.

The edition of bulletin No. 89—"Sanitary Conditions in the Home and on the Farm" of this Station, has been exhausted during the present year and, as there is still considerable demand for it, I would recommend that it be reprinted in the near future.

Nothing so readily gives practical value and general importance to experiment station work as an extended dissemination of the reports of its progress and accomplishment, in the solution of agricultural problems. As represented by a report of the Department of Agriculture, Washington, D. C., the production in 1904, of cereals in this country, including corn, wheat, oats, barley and rye, expresses a value of $1,950,000,000. Now, a movement directed by the experiment stations that would increase the production only a few bushels per acre and add to the value only a few cents per bushel, would, if published and disseminated among the people, revolutionize the interest in these agricultural industries.

All of which is respectfully submitted,

JOHN N. HOOK,
Secretary and Librarian.

REPORT OF THE HORTICULTURIST.

CLEMSON COLLEGE, NOV. 29, 1905.

Prof. J. N. Harper, Director, S. C. Experiment Station, Clemson College, S. C.

Dear Sir: I submit the following report of the Horticultural Division of the South Carolina Experiment Station from July 1, 1904, to June 30, 1905:

A large number of the experiments conducted in the Horticultural Division are the same as those mentioned in my last report. It is necessary to continue the notes on the fruit trees, grape vines, etc., from year to year, in order to be able to make

satisfactory reports on the fruitfulness, hardiness and quality of the fruits.

Apples: The old apple orchard has borne a fairly good crop of fruit this season and has enabled us to make accurate notes on the various varieties of summer, fall and winter apples. Many of these varieties have proved to be well adapted to this section of the State, while others have proved to be of little value. We have issued a bulletin on the results of our experiments with the varieties of apples during the past eight years. We have also conducted experiments on the methods of grafting apples, with special reference to the length of scions and whole and piece roots. The results of these experiments will soon be ready for publication.

Peaches: In the old peach orchard a large number of the varieties that proved to be of no value have been removed and a young orchard consisting of new varieties that had not been tested here has been planted. This orchard will bear its first crop the coming season.

Pears: The majority of the trees in our old pear orchard have been destroyed by blight, the Garbers being the only variety remaining. A young pear orchard consisting of a number of varieties has been set and every effort will be made to control the blight, in order to give these varieties a thorough test.

Plums: We fruited forty-five varieties of plums during the past season. Many of these varieties proved to be of little value, while some were very satisfactory indeed. Thinning and pruning experiments were also conducted with various varieties of plums.

Cherries: Our young cherry orchard fruited for the first time the past season. Some of the varieties were worthless, while a half dozen seemed to be well suited to this section.

Pecans: We now have in bearing sixty seedling pecan trees. These trees were all grown from first-class nuts, and the nuts from the trees now bearing show conclusively that it is very necessary to either bud or graft the pecans in order to secure first-class nuts. Variation in the seedling pecan is very great. The nuts vary from 65 to 192 to the pound, while it only requires from 30 to 38 first-class pecans to make a pound. We

have also conducted experiments with the different methods of budding and grafting pecans.

Grapes: Our notes on the varieties of grapes have been continued. We now have notes completed on ninety-two varieties of grapes. The majority of these grapes have done very well indeed with us, while others have proved rather weak growers, and altogether unsatisfactory. Experiments in pruning the grapes have also been conducted.

Scuppernongs: We have conducted very interesting experiments in pruning grapes of the rotundi-folia type, and although it is usually supposed that it will not do to prune these grapes, the results of our experiments show that the yield has been doubled where the vines are properly pruned. We hope to be able to publish the results of these experiments.

Variety tests have been conducted with the following small fruits: Raspberries, blackberries and strawberries.

Celery: We tested twenty-four varieties of celery during the past season, six of which have proved to be exceptionally fine, while many of the other varieties have done fairly well, some have failed entirely. We have continued the variety tests of celery for the past four years, and also have conducted experiments with the different methods of bleaching and storing the celery for winter use.

Variety and culture tests have been carried on with the following vegetables: Cabbage, cauliflower, egg-plant, tomatoes, onions, muskmelons and Irish potatoes.

In our experiments with Irish potatoes, we have secured better results from our second crop than from the first. The past season we grew the first and second crop on the same ground and secured one-third more by weight from the second crop than from the first.

Our experiments with cauliflower have also been very satisfactory, 90 per cent. of some of the varieties producing first-class heads, while six or eight varieties proved to be utterly worthless.

For the past three years we have been conducting experiments with blue grass for lawns, comparing spring and fall sowing on sandy and clayey soils. Our experiments are very much in favor of the fall sowing and clayey soil. We find the grass will

die out during the summer on sandy soil, while it resists the drought very well indeed on the clayey soil. Grass sown in October has in every case stood the winter and following summer much better than grass sown in February. This experiment was undertaken on account of the large number of inquiries received by this Division on the subject of lawns.

Yours respectfully,

C. C. NEWMAN,
Horticulturist.

REPORT OF THE ENTOMOLOGIST.

CLEMSON COLLEGE, S. C., Dec. 6, 1905.

Prof. J. N. Harper, Director S. C. Experiment Station.

Dear Sir: The study of the injurious insects of rice, which was begun last year in collaboration with the botanist to determine the agency of insects in the distribution of the disease known as rice blast, has resulted in a contribution to the biology of several well-known and hitherto unknown injurious insects of this crop. During the coming year this work will be continued.

My work on the cattle tick in cooperation with the Bureau of Entomology, United States Department of Agriculture, has for its object the determination of the following facts in the life history of the parasite: the exact time occupied in different months in oviposition, the exact time occupied during each month of the year in the development of the embryo, the exact time during different months that seed ticks can exist without being attached to a host, and the exact time occupied in the different months in the parasitic stage. The majority of the entomologists in the Southern States have agreed to assist in this work, and through their combined efforts, there are good reasons to believe that, with the cooperation of our educated farmers, the cattle tick will be finally eradicated from this country.

In the capacity of a consulting zoologist, I am studying the "stomach worm," or "twisted wire worm, " (Strongylus contortus Rud.). This parasite is affecting the health and causing

the death of the calves and young cattle of this State at an alarming degree. I can only report progress in this work.

Among minor investigations of the year, I have given some attention to a borer in the stem of the cowpea plant, an insect that, judging from the reports, may become a serious pest of this crop. Although the insect was brought to my attention late in the season, I have succeeded in rearing the adult, a phycitid moth. The life history of this cowpea stem-borer will be studied closely next season with the view of securing some practical way of fighting it.

In the list of injurious insects that have caused alarm during the season, mention should be made of the following: In the trucking sections of the coast counties, the Irish potato plants were badly damaged by the Southern leaf-footed plant-bug, (Leptoglossus phyllopus Linn.). Some damage was done to the cotton crop in the northeastern part of the State by an unusual large brood of a large grasshopper (Schistocerca alutacea Harr.). During the midsummer droughts, the cotton in the central part of the State suffered from the attacks of the red spider (Tetranychus gloverii Bks.). The corn crop of the entire State was greatly reduced by the destructive work of the corn stalk-borer (Diatraea saccharalis Fab.). In many localities the wire worms caused great loss.

Respectfully submitted,

CHAS. E. CHAMBLISS,
Entomologist.

REPORT OF THE BOTANIST AND BACTERIOLOGIST.

CLEMSON COLLEGE, S. C., Dec. 6, 1905.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: I beg to submit the following report:

The work in this Division has been continued under hopeful auspices with reference to the future, but with practically the same limitations as in the past. At the beginning of the fall term, the Division was moved into the Agricultural Building. The new quarters, while ultimately much better than the old, are not yet sufficiently equipped to be entirely efficient. The

continued delay in the erection of a greenhouse has occasioned a continuance of same disadvantages in working that have been described in previous reports. It is pleasing to note that at the date of writing, the prompt erection of a greenhouse appears to be assured.

Practically all of the time that the writer has been able to spare for investigation has been spent in the study of the rice blast. As stated in a preceding report, this is the only disease in the State that has threatened the existence of a great industry, and this critical situation has seemed to justify the expenditure of all of the botanist's time. The month of August, and portions of February, March, June, July and September have been spent in the rice district. Laboratory work on the disease has continued throughout the year, but in the absence of greenhouse facilities, it has been impossible to make inoculation experiments. I have no hesitation in saying that the use of a greenhouse during the past winter would have doubled the efficiency of my work and hastened its completion by six months. As it is, a great deal has been accomplished and the botanist will shortly be able to turn over the work in the form of an agricultural problem, the legitimate pathological work having been completed with the exception of certain features which require the use of a greenhouse. The details of the work and the results are not presented here, as a bulletin relating to the same will very shortly be issued. This work on the blast of rice has been carried on in cooperation with the Division of Vegetable Pathology of the United States Department of Agriculture.

The regular correspondence of the Division, which appears to be all the time increasing, has in the meantime been maintained. Preliminary investigations to those intended to run through a long term of years have been undertaken, with reference to the bacterial flora of soil of the Piedmont region. Observations on local sanitary conditions, as well as similar observations in the rice district of the State, have been continued, and two bulletins on the matter will shortly be issued. Bulletin 89, on sanitary subjects, has been exhausted. The great interest in sanitary matters manifested by this fact and by the amount of correspondence on the subject, indicates that this is

one of the most popular subjects for investigation, and it is needless to say that it is one of the most necessary subjects to be well understood. Upon the completion of the rice work, it would seem that this is the most hopeful line of investigation to be developed by this Division of the Station.

During his activity as botanist of this station, the writer has concentrated his work entirely upon pathological and bacteriological problems. There are, however, certain purely botanical problems that stand in urgent need of investigation and study. Among these are: (1) The question of seed purity and other matters regarding the commercial standard of seeds purchased in this State; (2), the problem of the utilization in cultivation of the many (almost unknown) native legumes; (3), a definite and thorough survey of the phanerogams of the State. All three of these problems are of fundamental importance, and it is to be hoped that they may be taken up within the next few years.

Respectfully submitted,

HAVEN METCALF,
Botanist and Bacteriologist.

REPORT OF THE VETERINARIAN.

CLEMSON COLLEGE, S. C., Nov. 28, 1905.

Prof. J. N. Harper, Director, South Carolina Experiment Station.

Dear Sir: I have the honor to submit the following statement of the work of the Veterinary Division of the Experiment Station:

On taking charge of this Division on November 1, 1904, I found awaiting attention several letters requesting information regarding a disease that was affecting calves and, in most cases, resulting fatally. As the disease could not be identified from the facts given by the correspondents, and as it appeared to be prevailing quite extensively and causing considerable losses, an investigation was made. The disease was found to exist on twenty-five farms in the northwestern part of the State, and from a study of the cases on five farms near the station, it was

found to be due to the presence of a small worm, the "twisted wire worm" or *strongylus contortus,* in large numbers in the fourth stomach of the affected animals. Medical treatment was prescribed which proved very successful in checking the disease, and methods were recommended for the eradication of the worms from the infested farms. A full account of the conditions under which the disease occurred, the symptoms, the appearance of the worm and the method of treatment was published in Bulletin No. 114. The study of the disease is being continued during the current year, in cooperation with the Division of Entomology and Zoology, to obtain additional information regarding the life habits of the parasite and the best practical means of eradicating it from infested farms.

Experiments were also made in connection with the treatment of "scours" in milk-fed calves, a disease which has proven very troublesome to those raising skim-milk calves. A method of treatment was discovered which proved very successful, and which it is believed will be of great value. The results of this work will soon be ready for publication in bulletin form.

Some preliminary work was done in the study of nodular disease of sheep, and information was obtained which will be of use when the subject can be taken up for further investigation.

The experiment begun by my predecessor with reference to the means of prevention and the treatment of parturient apoplexy (milk fever) of cattle, has been continued as opportunity afforded, but, as the work can only be prosecuted as cases occur in the station herd, and as these cases have been rather rare, a sufficient amount of data is not yet in hand for publication of results.

The plans of the Division for the ensuing year include, in addition to the work mentioned above, a series of co-operative experiments between a number of farmers in the State, this Division of the station, and the United States Department of Agriculture in testing several methods of eradicating the cattle tick from the farms and freeing the cattle of this parasite.

Respectfully submitted,

LOUIS A. KLEIN,
Veterinarian.

REPORT OF THE DAIRY AND ANIMAL HUSBANDMAN.

CLEMSON COLLEGE, S. C., Nov. 28, 1905.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: In accordance with your request, I present herewith a report of the work of the Department of Animal Husbandry and Dairying for the year ending December 31, 1905:

During the early part of the year the work of the department was in charge of the assistant, Mr. B. H. Rawl, who had outlined a number of experiments for the ensuing year. About the time these experiments were to be put into execution, Mr. Rawl received an appointment with the National Department of Agriculture, and Mr. J. M. Burgess was appointed his successor. As a result of these changes, no experiments were in progress in the department when the writer assumed charge in July, 1905. The work done since that time is briefly stated as follows:

Definite and systematic plans have been made with reference to the work with the different classes of live stock. It is our aim to build up a pure bred herd of strictly dairy animals, and also a pure bred herd of strictly beef animals.

In addition, grade herds are to be established by using the pure bred sires upon our common or native cattle. Similar plans have been made with reference to sheep and swine. It is believed that grading up with pure bred sires is the most feasible plan for the improvement of the live stock of South Carolina. The following pure bred animals of the highest types have already been purchased: A Jersey bull, a Jersey heifer, a Berkshire boar, and a Southdown ram. The department is now looking for a typical beef bull, which will in all probability be purchased in a very short time.

Plans have been completed for the construction of a piggery and sheep shed, and there is promise of having the buildings ready for occupancy by January 1, 1906. The breeding of horses and mules, a project now in contemplation, will also necessitate the construction of a horse barn.

During July a manure pit, with cement lining, was constructed by means of which it is possible to save all of the liquid as well as the solid excreta of farm animals.

A three months' feeding trial with twenty-two cows has just been completed. The experiment had for its object a study of the comparative value of wheat bran and cotton seed meal for milk production. The results will be published in bulletin form in the near future. The cotton seed meal experiments will be continued.

A bulletin on dairy farming is now in press and will be ready for distribution in a few weeks. A bulletin is also in preparation on the value of gathered cream plants for South Carolina.

Yours respectfully, JOHN MICHELS,
Dairy and Animal Husbandman.

Report of Chemist.

CLEMSON COLLEGE, S. C., Dec. 1, 1905.

President P. H. Mell.

Sir: I respectfully submit the following report of the Chemical Department of the Station for the year ending June 30, 1905:

The study of the production of starch from the sweet potato has been resumed. The work already done here on the subject has been reported in Bulletins 28, 30 and 63 of this Station. It is now proposed to erect a small experimental plant for the manufacture of the starch, and to have the product and by-product submitted to practical tests.*

With regard to what has been accomplished during the year, I have to report the following work of Mr. F. S. Shiver, assistant chemist: A chemical study of the tea industry in South Carolina, published in part. A chemical study of the tobacco industry in South Carolina, completed but not published. A considerable amount of work done in cooperation with the referees on insecticides and on dairy products, for the Association of Official Agricultural Chemists. A good deal of work for the Agricultural Department of the station in testing the burning qualities of tobacco grown under different conditions. Finally some miscellaneous work, including analysis of soils.

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*At this writing (December 1st) the building is completed and the necessary machinery is in place. The equipment of the factory as well as the chemical work is under the supervision of Mr. C. C. McDonnell, Assistant Chemist.

ANALYSIS OF COMMERCIAL FERTILIZERS.

Following is a report of the work on commercial fertilizers done under the direction of the Fertilizer Control Committee of the Board of Trustees:

	Season 1903-04.	Season 1904-05.
Official samples	402	522
Farmers' samples	125	19
Special official samples of cotton seed meal		84
	527	625

The small number of "farmers' samples" this year is due in part to the collection of samples at farms by the official inspectors instead of by the farmers themselves.

OFFICIAL SAMPLES OF FERTILIZERS.

The number of samples analyzed this year is 522. The analyses are given in full in Bulletin 115. The 84 samples of cotton seed meal collected at mills by special order of the Board of Fertilizer Control are not included here. The results of this investigation were fully reported in Bulletin 105.

CLASSIFICATION.

	1904.	1905.
Complete fertilizers	180	250
Acid phosphates	59	81
Acid phosphates with potash	75	82
Cotton seed meal	57	62
Kainit	11	26
Nitrate of soda	6	7
Muriate of potash	7	6
Sulphate of potash	2	0
Nitrate of soda with potash	0	1
Ground fish	2	3
Sulphate of ammonia	1	0
Tankage	1	0

	1904.	1905.
Dried blood	0	1
Miscellaneous	1	3
Total	402	522

DEFICIENT SAMPLES.

Of the 522 samples analyzed in 1905, thirteen brands were deficient under the law.

In addition to these, there were 165 samples which fell below the guarantee in one or more constituents, as follows:

In available phosphoric acid	35
In available phosphoric acid and ammonia	2
In available phosphoric acid and potash	1
In ammonia and potash	13
In ammonia	61
In potash	53
Total	165

The extent to which they fell below guarantee is shown in the following table:

	Below Guarantee—Per Cent.				
	.0-.10	.10-.25	.25-.50.	.50-1.00	1.00 and Over
In available phosphoric acid	7	13	6	8	4
In ammonia	25	29	17	5	0
In potash	8	22	20	12	5
Total	40	64	43	25	9

The number of brands deficient under the law is smaller this season than last. Thirteen out of 522, opposite 18 out of 402, or 2.49 per cent. opposite 4.48 per cent.

The relative number of samples falling below guarantee in one or more constituents, though not deficient in accordance with law, differs but little from last season, there being 165 out of 522, opposite 124 out of 402, or 31.61 per cent., opposite 30.85 per cent.

AVERAGES OF ANALYSES.

	1904. Per Cent.		1905. Per Cent.	
	Found.	Guaranteed.	Found.	Guaranteed.
ACID PHOSPHATES.				
Soluble phosphoric acid	11.09	.....	11.49	.....
Reverted phosphoric acid	3.23	.....	3.32	.....
Available phosphoric acid	14.32	13.61	14.81	13.99
Insoluble phosphoric acid	.78	.....	.76	.....
Total phosphoric acid	15.10	.....	15.57	.....
ACID PHOSPHATES WITH POTASH.				
Soluble phosphoric acid	7.33	.....	7.65	.....
Reverted phosphoric acid	3.79	.....	3.05	.....
Available phosphoric acid	11.12	10.13	10.70	9.98
Insoluble phosphoric acid	.82	.....	.66	.....
Total phosphoric acid	11.94	.....	11.36	.....
Potash soluble in water	2.81	2.71	3.07	3.03
COMPLETE FERTILIZERS.				
Soluble phosphoric acid	6.16	.....	6.45	.....
Reverted phosphoric acid	2.96	.....	2.74	.....
Available phosphoric acid	9.12	8.27	9.19	8.21
Insoluble phosphoric acid	1.50	.....	1.48	.....
Total phosphoric acid	10.62	.....	10.67	.....
Ammonia	2.99	2.93	3.12	3.05
Potash soluble in water	2.90	2.71	2.90	2.71
COTTONSEED MEALS.				
Available phosphoric acid	2.28	1.54	2.41	1.52
Ammonia	7.92	7.06	7.42	6.91
Potash soluble in water	1.54	1.21	1.54	1.01
KAINITS.				
Potash soluble in water	12.94	12.00	12.54	12.00
MURIATE OF POTASH.				
Potash soluble in water	49.79	49.72	50.49	49.33
SULPHATE OF POTASH.				
Potash soluble in water	53.47	.....	.....	.....
NITRATE OF SODA.				
Ammonia (equivalent)	18.87	18.00	18.73	16.86

There were five samples of Sea Island meal this year. They are not included in the foregoing table. They averaged 4.73 per cent. of ammonia found, 4.80 per cent. guaranteed.

The available phosphoric acid and potash in cotton seed meal were guaranteed in only forty-one samples, but these ingredients were determined in all cases.

With regard to the 84 samples of cotton seed meal collected at mills by special order of the Board of Fertilizer Control, the following averages are presented:

	Found. Per cent.	Guaranteed. Per cent.
Available phosphoric acid	2.34	1.50
Ammonia	7.52	7.05
Potash soluble in water	1.56	1.00

The following table shows the yearly averages of fertilizer analyses from the time the Board of Trustees of this College took charge of the station work down to the present time:

YEARLY AVERAGES OF ANALYSES FROM 1891 TO 1904, INCLUSIVE.

Season.	Acid Phosphates.		Acid Phosphates with Potash.			Complete Fertilizers.				Cottonseed Meals.				Kainits.		Muriate of Potash.		Nitrate of Soda.	
	Number of Samples.	Available Phosphoric Acid, Per Cent.	Number of Samples.	Available Phosphoric Acid, Per Cent.	Potash Soluble in Water, Per Cent.	Number of Samples.	Available Phosphoric Acid, Per Cent.	Ammonia, Per Cent.	Potash Soluble in Water, Per Cent.	Number of Samples	Available Phosphoric Acid, Per Cent.	Ammonia, Per Cent.	Potash Soluble in Water, Per Cent.	Number of Samples.	Potash, Per Cent.	Number of Samples.	Potash, Per Cent.	Number of Samples.	Ammonia, Per Cent.
1890-1. . . .	49	13.02	19	11.84	1.65	173	9.34	2.68	1.96	30	.....	8.37	.....	21	12.75	1	51.96	1	19.22
1891-2. . . .	29	12.92	16	11.50	1.49	112	8.83	2.80	1.95	25	.....	8.21	.....	18	12.51	.....	.....	1	18.63
1892-3. . . .	48	12.32	26	11.63	1.22	150	9.00	2.91	1.65	20	2.62	8.40	1.32	20	12.05	.....	.....	.....	.....
1893-4. . . .	46	13.24	22	12.01	1.51	132	9.27	2.53	1.79	22	2.45	8.64	1.69	17	12.37	.....	.....	.....	.....
1894-5. . . .	46	13.55	15	12.09	1.66	87	9.42	2.55	1.77	33	2.58	8.19	1.66	19	12.30	.....	.....	.....	.....
1895-6. . . .	42	13.43	26	11.99	1.39	115	9.31	2.64	1.86	34	2.57	8.45	1.61	16	12.45	.....	.....	.....	.....
1896-7. . . .	59	13.61	34	12.06	1.61	117	9.55	2.70	1.91	40	2.53	8.69	1.64	22	12.44	.....	.....	.....	.....
1897-8. . . .	63	13.67	50	11.54	2.06	141	9.15	2.70	1.93	39	2.37	8.39	1.58	20	12.68	.....	.....	1	19.23
1898-9. . . .	73	13.74	68	11.77	1.99	134	9.32	2.73	2.21	40	2.76	8.25	1.75	14	12.78	2	51.93	2	18.96
1899-1900 . .	73	13.58	63	11.58	2.00	124	9.50	2.73	2.13	52	2.27	8.73	1.63	8	12.73	4	50.95	3	19.01
1900-1. . . .	56	14.00	55	11.49	2.65	139	9.40	2.87	2.47	60	2.38	8.55	1.54	12	12.61	2	48.92	3	18.96
1901-2. . . .	45	14.11	51	11.09	2.55	141	9.39	2.84	2.34	49	2.57	7.93	1.63	16	12.85	4	50.54	3	19.03
1902-3. . . .	51	13.74	55	10.94	2.65	139	9.02	2.69	2.42	69	2.27	8.08	1.48	15	12.92	2	50.25	2	19.15
1903-4. . . .	59	14.32	75	11.12	2.81	180	9.12	2.99	2.90	57	2.28	7.92	1.54	11	12.94	7	49.79	6	18.87
1904-5. . . .	81	14.81	82	10.70	3.07	250	9.19	3.12	2.90	62	2.41	7.42	1.54	26	12.54	6	50.49	7	18.73

In this table, as in the foregoing ones, the ammonia yielded by the nitrogen in fertilizers is given instead of the nitrogen itself, as in the trade goods are still bought and sold on the ammonia basis. The per cent. of nitrogen is readily calculated, as fourteen-seventeenths of the weight of the ammonia is practically the weight of the nitrogen it contains.

There still continues the general improvement in the character of acid phosphates and complete fertilizers which was noted in the last annual report.

With regard to cotton seed meals, it is to be observed that the average percentage of ammonia is even less than it was last year.

GRADES.

In the following table the number of acid phosphates, acid phosphates with potash, and complete fertilizers of each grade, according to guarantee, is placed side by side with the number found by analysis to belong to that grade, fertilizers having commercial values equal to those of schedule grades being classed in those grades:

	High.		Standard.		Low.	
	Claimed.	Found.	Claimed.	Found.	Claimed.	Found.
Complete fertilizers..(250)	118	133	124	111	8	6
Acid phosphates with potash .....(82)	38	73	42	7	2	2
Acid phosphates .....(81)	79	76	2	5	0	0
Total .....(413)	235	282	168	123	10	8

These results are due to the following changes in grades ascertained by analysis:

	Low to High.	Low to Standard.	Standard to High.	High to Standard.	High to Low.	Standard to Low.	No Change.
Complete fertilizers ....(250)	0	4	18	3	0	2	223
Acid phosphates .....(81)	0	0	1	4	0	0	76
Acid phosphates with potash .....(82)	1	0	34	0	0	1	46
Total .....(413)	1	4	53	7	0	3	345

This shows that out of 413 samples, 345 were of the grade claimed for them, 58 were of a higher grade and 10 of a lower grade than that claimed for them.

Last year out of 314 samples, 256 were of the grade claimed for them, 44 were of a higher grade, and 23 of a lower grade than that claimed for them.

This matter of grades is to some extent misleading, as there may easily be a difference of several dollars a ton in the money value of fertilizers or of cotton seed meals included in the same schedule grades. In purchasing the farmer should be governed not by the "grade" claimed, but by the percentages of the essential constituents which are guaranteed.

FARMERS' SAMPLES OF FERTILIZERS.

In addition to the samples of fertilizers collected by the official inspectors, there have been analyzed 19 samples for individual farmers in accordance with Section 1540 of the law with regard to commercial fertilizers. It is to be remarked, however, that 49 of the 522 official samples were drawn by the regular inspectors at the request of farmers who preferred this method, so that really 68 samples in all have been analyzed for individual purchasers.

WATER.

There have been made during the year 34 sanitary examinations and 21 complete analyses of waters from different parts of the State.

COOPERATIVE WORK.

Mr. C. C. McDonnell and Mr. F. C. Atkinson, assistant chemists, have done a considerable amount of work in cooperation with the referee on potash, for the Association of Official Agricultural Chemists.

DISTRIBUTION OF THE WORK.

Fertilizers were analyzed by Messrs. C. C. McDonnell, B. F. Robertson, F. C. Atkinson and W. E. Dickinson; waters by Mr. D. H. Henry. Dr. R. N. Brackett has aided me in office duties.

Very respectfully,

M. B. HARDIN,
Chief Chemist.